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ABSTRACT

A study involving 256 adolescents focused on differences in results on androgyny from administration of the Bem Sex Role Inventory (BSRI). The subjects ranged in age from nine to 17 years. The subject group was 75% male and 25% female. Confirmatory and second-order factor analyses of the data were used. Results based on confirmatory maximum likelihood factor analysis were not especially supportive of a good fit between model expectations and the data at hand. This finding is not consistent with previous research in which confirmatory techniques were employed to analyze BSRI data. Results of second-order factor analysis were more supportive of the validity of the BSRI. Again, this finding is not consistent with previous BSRI research in which second-order methods were used. Various studies suggest that the construct of androgyny has important theoretical and practical implications for psychologists, and it appears that the BSRI can contribute to research in this area. (TJH)

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Confirmatory and second-order factor analyses of androgyny data from adolescents

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ABSTRACT

The present study employed data from adolescents to evaluate the structure underlying responses to the Bem Sex-Role Inventory, a popular measure of androgyny. Both confirmatory and second-order factor analytic methods were employed, with mixed results as regards conclusions involving the validity of the measure.

In a seminal article in the literature on personality, Constantinople (1973) argued that persons could possess both characteristics that are stereotypically male as well as characteristics that are stereotypically female. Personality researchers have come to call such persons androgynous. Bem (1975, p. 634) has argued that "a non-androgynous sex role can seriously restrict the range of behaviors available to an individual as he or she moves from situation to situation." Kelly and Worrell (1977) summarize studies that have empirically tested the proposition that androgyny is an adaptive personality characteristic. Generally studies support Bem's position, though some studies (Heilburn, 1984) suggest that the trait may be more advantageous to females than to males.

While several measures of androgyny have been developed, the Bem Sex-Role Inventory (BSRI) (Bem, 1974) "has been the most frequently used of the recent sex role instruments" (Koenigsberg, 1982, p. 2). However, the BSRI and the methods used to measure the androgyny construct have both been topics of heated academic discussion (e.g., Bem, 1979; Pedhazur & Tetenbaum, 1979).

Studies of the BSRI measure have been extraordinarily diverse in their methods and designs. Sample sizes have ranged from 44 (Bledsoe, 1983) to 894 (Sassenrath & Yonge, 1979). Powell (1979) employed 15 samples to cross-validate his results. Although many studies have used variations of common factor analysis to evaluate the measure, researchers have also employed multidimensional scaling (Koenigsberg, 1982), smallest space analysis (Ruch, 1984), confirmatory factor analysis (Marsh, 1985), analysis of the variance/covariance matrix (Belcher,

Crocker & Algina, 1984), and extraction of second-order factors (Edwards, Gaa & Liberman, 1978). Thompson (1986) presented a meta-analytic integration of the various factor analytic studies and concluded that the theoretically expected structure underlies BSRI data. Even seemingly contradictory results are generally supportive of the measure's validity once solutions are rotated into a common factor space.

However, most of the studies in this area have employed college students as subjects. The similar character of most of the samples limits ability to generalize about the validity of the BSRI. As Worell (1978, p. 783) notes, "restricting all of the sex-role research to college students, unfortunately, leaves us with many unanswered questions about the generality of results and the applicability to constrast populations." It is especially surprising that so few studies have employed adolescents as subjects, although there are a few exceptions (Mills, 1980) to this generalization. Bem (1979, p. 1052) argues that even young children are aware of sex-roles. Marsh and Myers (1984) tested adolescent girls but school officials allowed the use of only a subset of BSRI items.

The present study was conducted to investigate differences in BSRI results involving developmentally different subject groups. The study was also conducted to replicate results from previous studies involving older subject groups but which did employ confirmatory and second-order analytic methods.

Confirmatory factor analytic methods (Joreskog & Sorbom, 1984) are valuable because the methods offer statistical tests of

how well a priori models characterize actual data, and thus the methods are theory oriented. As Gorsuch (1983, p. 134) argues,

> Confirmatory factor analysis is powerful because it provides explicit hypothesis testing for factor analytic problems. Exploratory factor analysis should be reserved only for those areas that are truly exploratory, that is, areas where no prior analyses have been conducted... [In comparison with traditional exploratory methods,] confirmatory factor analysis is the more theoretically important--and should be much more wisely used--of the two major factor analytic approaches.

Confirmatory methods may be underutilized because the methods require large samples of subjects relative to number of variables (Gorsuch, 1983, pp. 128-129).

Second-order factor analytic methods also have important applications, though as Kerlinger (1984, p. xiv) notes, "while ordinary factor analysis is probably well understood, second-order factor analysis, a vitally important part of the analysis, seems not to be widely known and understood." Second-order factor analysis involves the extraction of factors, the rotation of these "first-order" factors to oblique or correlated positions with respect to each other, and then the analysis of the interfactor correlation matrix to extract "second-order" factors. Thompson and Borrello (1986) present an example application.

Subjects

The subjects in the present study were 256 adolescents ranging in age (mean = 12.9; SD = 1.86) from 9 to 17. The sample consisted of more males (75%) than females.

Results

Confirmatory Maximum-Likelihood Analyses

Bem (1981) has proposed a short form of her instrument constructed by scoring only 20 items on the BSRI. Indeed, the short- and long-form scores are highly correlated (Bem, 1981, p. 15), and the short-form Masculine scale score is at least as reliable as the long-form M scale score and the short-form Feminine scale score is noticeably more reliable than its long-form counterpart (Bem, 1981, p. 14). Since confirmatory factor analytic methods (Joreskog & Sorbom, 1984) require relatively large sample sizes relative to numbers of items, and since the structure underlying only the 20 short-form items has not been as widely explored, the confirmatory analysis in the present study was conducted solely on these items.

Table 1 presents maximum-likelihood estimates of the factor structure matrix for a two-factor solution involving these 20 scored items. The chi-square test statistic for goodness-of-fit of the expected structure to the data was 582.6 (df=170). However, since this test is sensitive to sample size and to any deviations from distributional assumptions, Joreskog and Sorbom (1984) recommend the interpretation of a goodness-of-fit index. The index was computed to be .80.

INSERT TABLE 1 ABOUT HERE.

Second-Order Factor Analyses

The eigenvalues for the first six factors were 5.7, 4.4, 1.9, 1.9, 1.7, and 1.5. Thirteen factors had eigenvalues greater than one. These results suggest that two g or general factors underlay responses, although more first-order factors might reasonably be extracted. The numbers of factors extracted by researchers have included two (Bledsoe, 1983), four (Pedhazur & Tetenbaum, 1979), and five (Hoferek, 1981).

Given previous variations in numbers of first-order factors extracted and the eigenvalues in the present study it was decided to extract four first-order factors. Two factors were extracted from the interfactor correlation matrix and then rotated to the varimax criterion. Some researchers (Kerlinger, 1984) then directly interpret these second-order factors, but Gorsuch (1983, p. 245) suggests that this amounts to interpreting interpretations of interpretations of the original variables and is inappropriate. Therefore, the first-order pattern coefficient matrix was multiplied by the second-order pattern coefficient matrix and the product matrix was rotated to the varimax criterion. The structure produced in this manner is reported in Table 2.

INSERT TABLE 2 ABOUT HERE.

Discussion

The Table 1 results based on confirmatory maximum likelihood factor analysis were not especially supportive of a good fit between model expectations and the data in hand, as indicated by

a modest goodness-of-fit index. This result is not consistent with previous research in which confirmatory techniques were employed to analyze Bem Sex-Role Inventory data (Marsh, 1985). However, the previous study employed a hybrid of BSRI items rather than either only the short-form items or all the long-form items. But results in the present study may not replicate in even larger samples, and these sophisticated confirmatory approaches are very large-sample methods (Gorsuch, 1983, p. 128-129), as noted previously.

However, the results of the second-order factor analysis reported in Table 2 were more supportive of the validity of the measure. This result is not consistent with previous BSRI research in which second-order methods were employed (Edwards, Gaa & Liberman, 1978). However, Edwards et al. (1978) extracted 17 first-order factors in their study. A more complex second-order structure may result as more first-order factors are extracted. The extraction of a large number of first-order factors does not appear to be consistent with the apparent existence of two q first-order factors, as suggested by eigenvalues reported in a variety of studies (e.g., Gross, Batlis, Small & Erdwins, 1979).

In summary, various studies suggest that the construct of androgyny has important theoretical and practical implications for psychologists (Bem, 1975; Kelly & Worrell, 1977). Many studies (Thompson, 1986) have supported the validity of the most popular (Koenigsberg, 1982) measure of androgyny, the Bem Sex-Role Inventory. The results of the present study, and in

particular the results of the second-order factor analysis, suggest that the Bem Sex-Role Inventory does have promise as a research instrument, although additional evidence is needed regarding the structure of the BSRI when the measure is employed with adolescents.

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Table 1
Maximum Liklihood Factor Matrix

Variable	I	II
Willing take stand	.618	--
Leadership abilities	.591	--
Dominant	.538	--
Forcefuful	.509	--
Strong personality	.490	--
Aggressive	.461	--
Defend my own beliefs	.352	--
Assertive	.349	--
Independent	.306	--
Willing take risks	.298	--
Warm	--	.581
Tender	--	.562
Love children	--	.560
Gentle	--	.512
Compassionate	--	.296
Eager soothe hurt	--	.233
Sympathetic	--	.134
Understanding	--	.127
Affectionate	--	.116
Sensititive needs	--	-.097

Note. The 10 Feminine short-form items are presented following the 10 Masculine short-form items. Items have been sorted in descending order by the value of the coefficients.

Table 2
Varimax Rotation of First-by-Second Order Product Matrix

	Item	I	II
1	Defend my own beliefs	.42	.01
2	Independent	.40	.28
3	Assertive	.26	.18
4	Strong personality	.48	.25
5	Forceful	.40	-.08
6	Leadership abilities	.59	.12
7	Willing take risks	.22	-.06
8	Dominant	.44	.04
9	Willing take stand	.61	-.01
10	Aggressive	.41	-.17
11	Self-reliant	.47	.25
12	Atheletic	.27	-.09
13	Analytical	.39	.12
14	Decisions easily	.48	.11
15	Self-sufficient	.53	.11
16	Individualistic	.37	.17
17	Masculine	.33	-.20
18	Competitive	.54	.12
19	Ambitious	.51	.14
20	Act as a leader	.53	.21
1	Affectionate	.04	.50
2	Sympathetic	.04	.54
3	Sensitive needs	.19	.43
4	Understanding	.17	.44
5	Compassionate	.18	.41
6	Soothe hurt	.27	.53
7	Warm	.13	.66
8	Tender	-.09	.64
9	Love children	.01	.40
10	Gentle	.17	.55
11	Yielding	.16	.25
12	Cheerful	.36	.25
13	Shy	-.24	.28
14	Flatterable	.03	.37
15	Loyal	.38	.21
16	Soft-spoken	-.27	.50
17	Gullible	-.33	.36
18	Childlike	-.36	.21
19	No harsh language	-.01	.17
20	Feminine	-.26	.31

Note. The 20 Feminine long-form items are presented following the 20 Masculine long-form items.